

56

Ed
130

BEEES WASPS & ANTS

AND L. T
DUNCAN

WONDERS
OF INSECT
LIFE





Ed
130

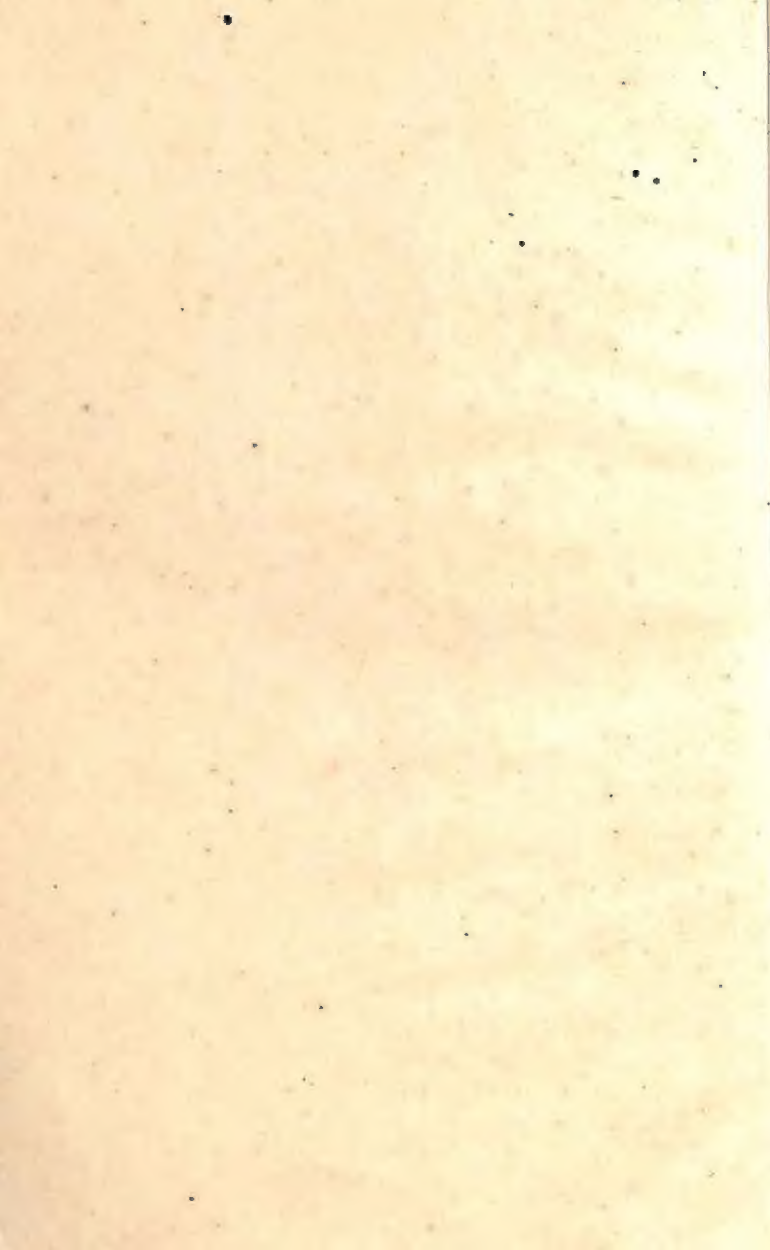
Ch

~~64~~
~~112~~

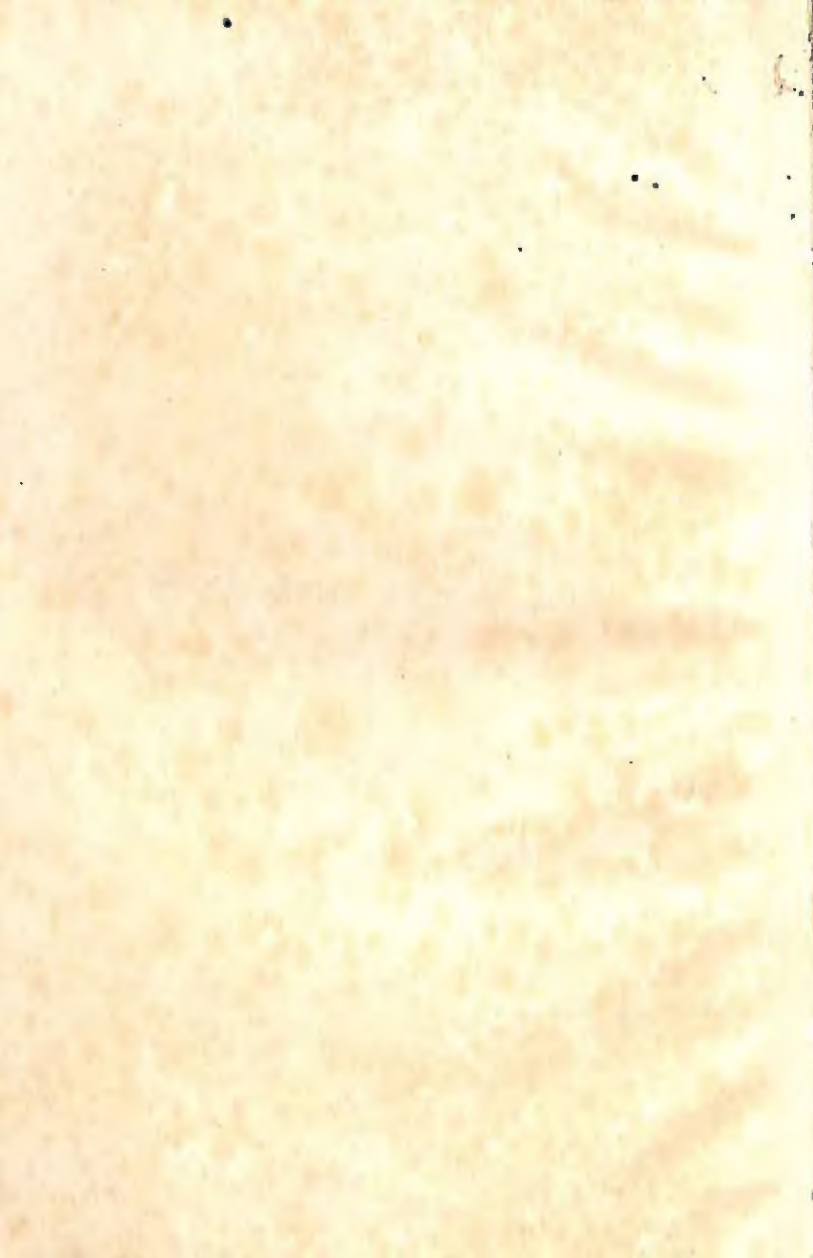
~~7754~~
SIF

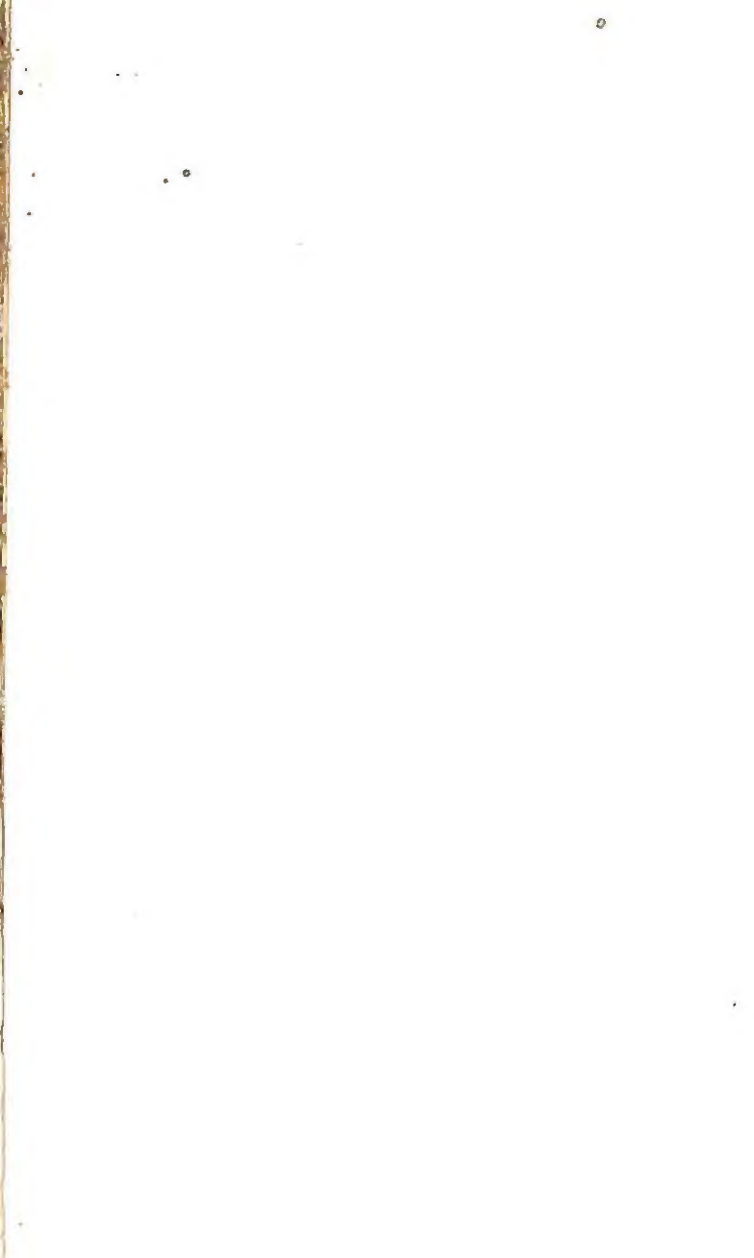
GOVT. BUREAU
OF INDIAN AFFAIRS
SCHOOL

7754
S-1-E



BEEES, WASPS, AND ANTS







BUMBLE BEE GATHERING HONEY

The book cover features a highly decorative border. At the top, a large oval frame contains the title. Below this, a central shield-shaped area contains the subtitle. The bottom of the cover is adorned with two detailed illustrations of beetles, one on each side of the publisher's information. The entire design is framed by intricate floral and vine patterns, with various insects like bees and wasps subtly integrated into the foliage.

WONDERS OF INSECT LIFE

F·MARTIN·DUNCAN
F·R·M·S·F·R·P·S
·G·L·T·DUNCAN·

BEEES·WASPS AND ANTS

LONDON
· · · HENRY · FROWDE · · ·
OXFORD · UNIVERSITY · PRESS
· HODDER & STOUGHTON ·
WARWICK · SQUARE · E · C



U.S.N.Y. V. E. AMERAS

Page.....26.7.05

Comm. No. 11669

CONTENTS

	PAGE
I. THE HOME OF THE HONEY BEE—THE HIVE AND ITS BUSY INMATES	7
II. WORKERS AND DRONES — THE WORKER'S TOOLS—THE LIFE AND SAD FATE OF THE DRONES	13
III. THE LIFE OF A WORKER BEE—CARE OF THE QUEEN—BABY BEES—A WORKER'S FIRST DAYS IN THE HIVE	21
IV. HOW THE BEES SWARM—ROYAL CELLS— THE ANGRY QUEEN—THE BEES SWARM —THE NEW CITY	28
V. QUEEN OF THE HIVE — A NEGLECTED PRINCESS — HER FIRST FLIGHT — THE NEW QUEEN	37
VI. BUMBLE BEES—BEES AND FLOWERS—THE NEST OF THE BUMBLE BEES—THE QUEEN MOTHER	43
VII. SOLITARY BEES—THE LEAF-CUTTING BEES— MINER BEES—THE CARDER, CARPENTER, AND MASON BEES	51

	PAGE
VIII. WASPS AND THEIR WAYS—THE QUEEN WASP—THE NEST—THE WORKERS— BABY WASPS—THE LITTLE HUNTERS— THE END OF THE COLONY	59
IX. SOCIAL AND SOLITARY WASPS—HORNETS— WOOD WASPS—SAND WASPS	67
X. THE LITTLE PEOPLE—ANTS AND THEIR WAYS—SLAVE - MAKING ANTS—ROBBER ANTS, ETC.	76

$$\begin{array}{r} 22 \overline{) 56} \\ 44 \\ \hline 130 \end{array}$$

$$\begin{array}{r} 82 \\ 72 \\ \hline \end{array}$$

CHAPTER I

THE HOME OF THE HONEY BEE

HAVE you ever stood by a bee-hive on a warm summer morning, listened to the deep hum of the bees, and watched the busy little inhabitants as they hurry in and out of the hive?

You need not be afraid to watch them so long as it is not a windy or a thundery day—both wind and thunder upset the little people, making them bad-tempered and inclined to sting anyone who comes in their way. On a bright summer day, with the hot sun shining, the bees are quite good-tempered, and far too busy to waste their time in stinging, unless they are annoyed. We must not, of course, stand right in front of the hive, so as to block the entrance and prevent the bees flying straight in and out; but if we stand just a little to one side, and do not fidget about, the bees will not mind us and we need have no fear.

At first as we watch the busy hive all seems bustle and confusion. Thousands of little black bees are buzzing in and out, while the air is alive with the deep humming note of the throngs of hurrying little creatures. But the bees are not really just dashing in and out of the hive in a reckless fashion, or buzzing round and round in a merry, airy dance. We soon see that there are two steady streams of bees—one coming out and the other going into the hive.

The bees coming out of the hive rise up at once into the air and are off and away with a swift, strong flight to the flowering meadows, the clover fields, or to the orchards when they are in bloom.

The home-coming bees fly more slowly, for they are heavily laden with their spoils. Some have their honey-bags filled with sweet nectar, gathered from the flowers ; some carry balls of pollen—golden, orange, pale yellow, white, or brown, according to the flowers upon which they have been at work ; other bees are water-carriers, and are carrying home supplies of water from the nearest stream to the workers inside the hive.

As soon as the bees enter the hive they

THE HOME OF THE HONEY BEE 9

waste no time, but give up the honey, or water, or pollen, to the first stay-at-home bee they meet, then at once they hurry off again to fetch another load.

Inside the hive the bees are just as busy ; here all sorts of work is going on. At the entrance are the sentinels guarding the city gates. They know the rightful citizens and allow them to pass in and out without question ; but no strange bee is permitted to enter the hive, unless she brings a present of honey or pollen. Then the guards will let her pass in to give up her present to one of the house bees and go out again unharmed.

There are rows of bees standing on the alighting board with their heads turned towards the hive, all fanning their wings as fast as they can go. They are ventilating the hive, driving in a current of fresh cool air, to prevent it growing too hot within. A certain number of bees take turns at this work. Every now and then one will stop fanning and fall out of the rank, and another bee immediately takes her place. In the summer time the fanning never ceases, but is kept up night and day ; and the wings of the little creatures make such a strong draught

10 BEES, WASPS AND ANTS

that if a lighted candle is brought near it will be blown out !

Inside the hive great walls of comb stretch from the roof almost to the floor, with narrow



BEES REMOVING A FLOWER FROM THE ALIGHTING BOARD
OF THE HIVE.

roadways running between them along which the bees pass up and down on their daily task. Hundreds of bees are at work here, not all doing the same thing; each bee has her own special business to attend to, she knows what

THE HOME OF THE HONEY BEE 11

she has to do and works away at her task without any fuss or confusion.

Gangs of carrier bees hurry up and down the roadways with loads of pollen to be stored in special pollen bins, or nectar for the honey makers ; housemaids are hard at work clearing away every scrap of refuse, carrying it out of the gates and dropping it over the edge of the foot board. No untidiness, not a single speck of dust or dirt is allowed in the bee city ; and if a leaf or a flower falls upon the alighting board, at once a little troop of bees comes hurrying from the hive, and pulls and pushes and tugs at it until at last it is tipped over the edge.

In one corner of the hive a number of bees are busy making wax ; elsewhere the builders and masons of the city are building new comb. In the upper stories of the hive the honey-makers are at work pouring the sweet syrup into the honey-comb, while others are sealing the cells, that are already filled, with a lid of wax.

In the centre of the combs, the warmest place in the hive, are the nurseries, and here the nurses are looking after the baby bees. They pass from cell to cell and feed all the

hungry children, who open their mouths just as little birds do when mother bird brings a nice fat caterpillar to the nest. The youngest babies are fed with "bee-milk," a thick, white syrup made from honey and pollen, but the older children are given honey alone. Nursemaids are busy cleaning out empty cells in readiness for the queen when she next comes round to lay eggs in them; and a bevy of bees are attending on her Majesty, never leaving her for a moment, as she moves slowly over the brood combs, laying a tiny egg in each cell as she passes by.

And so in the busy city of the honey bees the work goes steadily on all through the long summer days, while outside in the sunshine the foragers are hurrying backwards and forwards bringing in fresh supplies of food to the hive; but should the clouds gather in the sky, home they all flock, and the hive is soon crowded from floor to ceiling. You would think that those bees who had been out and about collecting honey and pollen, and carrying their heavy loads home to the hive, would now take a well-earned rest. But no, after they have refreshed themselves with a little honey and pollen, from the cells that

are left open for the general use of the hive, they set to work to help the house bees in every way they can. Never were such busy, energetic little people !

CHAPTER II

WORKERS AND DRONES

In every hive there are three kinds of bees—

The worker bees, who do all the work.

The drones, who do
no work at all.

And the queen bee
who is the mother of
the hive.

The worker bee is
but a homely-looking
little insect, dressed in
a sober suit of darkest
brown. Nevertheless,
she is a truly wonder-

ful little creature, every part of her small,
trim body has its own special use. She is
armed with a sharp poisoned dagger to defend



QUEEN BEE,
WORKER, AND DRONE.

herself against all comers, and she carries a regular set of tools to help her in all her different kinds of work.

Each Worker bee has :

A sucking tube for drawing up the nectar from the flowers.

A honey bag to carry it home in.

Pollen baskets to hold the pollen.

Brushes and combs.

A strong, sharp pair of shears.

And a number of pockets to hold wax.

The shears are the bee's jaws, two strong blades which work sideways like a pair of

scissors. With these she clips off little pieces of wax and moulds them into shape when she is at work building the honey-comb.



THE BEE'S BRUSH AND COMB.

Her brushes and combs she carries on her legs (a bee

has, of course, six legs as all insects have); each leg has no less than nine joints, and on nearly every joint is a brush of stiff bristles,



TUL. HOME OF THE HONEY BEE



A SWARM OF BEES

while the hind legs are furnished with a perfect little curry comb.

The bee's hind legs are different from the other two pairs ; they are longer, and the upper part is much broader and hollowed out like a spoon. Round the hollow are rows of stiff bristles, curving inwards, making a handy basket for "Miss Bee" to carry the pollen in. When she dives head-long into a flower, such as a Canterbury bell, a larkspur, or a foxglove, her



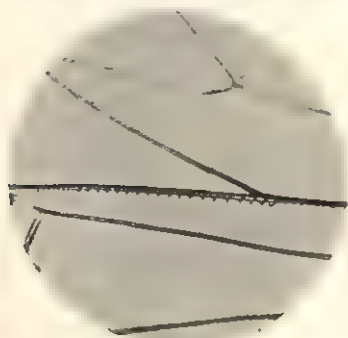
THE BEE'S POLLEN BASKET.

whole hairy little body is covered with a shower of fine pollen dust. Then out she comes again, carefully brushes and combs the pollen out of her hair, and, after moistening it with her tongue and kneading it into a ball, she packs it into her pollen basket.

When collecting honey the bee uses her sucking tube. This is really a very long underlip which looks rather like an elephant's trunk. The trunk is pushed down into the narrow

tubes of the flowers, and the sweet nectar is drawn up into the bee's mouth ; it then passes down her throat into the honey bag, and so is carried home to the hive.

Besides all these tools the bee has four gauzy wings ; strong enough, although they look so frail, to bear her quite long distances through the air. A



PART OF A BEE'S WING, SHOWING
THE LITTLE HOOKS THAT JOIN
THE TWO WINGS TOGETHER.

bee will often fly as far as two or three miles from the hive to fetch honey and pollen if there are no good collecting grounds nearer home. On each hind wing is a row of tiny hooks which (when the

bee is flying) hook into a fold in the lower edge of the front wing, joining them firmly together. So the two wings move as one, giving the bee a stronger, swifter flight than if they worked separately in a fluttering fashion.

The bee's eyes are two great globes, one on each side of her head. They are called com-

pound eyes, because they are cut up into thousands of tiny windows, like the facets of a diamond, each one slanting in a slightly different direction; so the bee can see all ways at once without the trouble of turning her head. With these big eyes she finds her way across country and home again, but in the dim light of the hive they are not much use to her, so on her forehead she has three simple eyes, just tiny specks of light to guide her about the city. But the bee does not depend for guidance on her



THE HEAD OF A BEE.

eyes alone; when going about her different tasks she constantly touches and feels everything that comes in her way with her antennæ—the two little feelers in front of her head.

The bee's sting is a wonderful little weapon. It is a tiny sword with three blades. Each blade has a barbed edge, and at the base of the sting is a little poison bag. When the sword is not in use, the three blades fit closely

together, but when Miss Bee plunges it into an enemy they separate, and at the same time each blade is drenched with a burning fluid from the poison bag. No wonder the sting of a bee is so painful !

The drone is much larger than the worker bee, and he spends his life in quite a different

way. While his industrious sisters toil from morning till night the whole summer through the great idle drone does nothing but enjoy himself. Not a thing does he do to help in the work of the bee city, but



THE STING OF A BEE.

he sleeps and eats, and blunders in and out of the hive, rudely bumping into the workers as they pass to and fro with their loads of honey and pollen.

The worker bees are abroad quite early on a summer's morning, but the drones never leave the hive until the sun has had time to warm the day. They pass the early morning hours indoors, comfortably

sleeping in the warmest corners of the hive, helping themselves to pollen and honey from the common provision cells, or getting in the way of the worker bees. Then about noon out they all rush with a great, booming noise, dance madly round the hive for a minute or two, and then fly gaily off to sport and play in the sunshine.

The drone is always scorned for his lazy, useless ways, but it is hardly fair to blame him altogether, for, as a matter of fact, he could not work even if he wished to. The drone has no tools, as the worker bee has; he has no brushes and combs, no pollen baskets, no wax glands, and his trunk is not long enough to draw up the nectar from the flower. He is altogether a helpless creature; he cannot even feed himself entirely, for although he greedily laps up far more than his own share of honey from the honey combs, this sweet food does not satisfy him; so the tiresome fellow is always worrying the house bees for bee milk, and he sits up to be fed like a great big baby!

Although he is such a big, burly fellow, the drone is no match for the little worker bee, for he has no sting, and from so long being idle and lazy he has become stupid too. Yet

LIBRARY, U.S. ARMY

Date.....



all through the summer days the workers patiently feed the drones and put up with their tiresome, blundering ways. But they do not love their lazy brothers, and when the days begin to grow shorter the bees know that autumn is approaching, when nectar and pollen will become so scarce they will no longer be able to gather enough to feed all the drones and workers in the hive.

Then the workers hold a council, and determine that no longer shall the useless members of the hive be allowed to waste the provisions of the city. Winter is approaching, and all the stores will be needed to keep the useful citizens alive to carry on the work of the hive in the following year. The drones must go.

So first the workers go to the drone cells, in which the baby drones are lying. They seize the little things in their jaws and carry them out of the hive. Then they turn upon the unfortunate drones, and, in spite of their protests, they drive them from the city. The bees do not sting the drones; they hustle and push and drag them to the gates, bite through one wing so that they will not be able to fly back again, and tumble them over the edge of the foot-board.

The poor drones are terrified, and struggle madly with their assailants. A few manage to escape and fly away, but this does not help them; they cannot gather nectar for themselves, so hunger soon drives them back to the hive. There they find a number of workers guarding the city gates, who drive them off again, or fall upon them and tear their wings. So the poor drones all die of cold or hunger—not one is left.

We cannot help feeling sorry for the drones, who have led such a gay and careless life until this terrible fate overtakes them. It seems cruel to us that they should be killed in this way. But the bees, although they show no mercy, are perfectly just and wise. Their one care is the welfare of the city. To save the workers from starvation the drones must go, for the bees cannot afford to keep idlers through the winter.

CHAPTER III

THE LIFE OF A WORKER BEE

THE queen bee is the most important person in the bee city. She is the mother of the

26.7.05
11/19



hive, and all the bees in it are her children. Although she is called a "queen" she does not rule the hive; the worker bees are the true rulers; they plan and carry out all the work and settle all the affairs of the city; they guard the queen, and tell her what to do. The queen's work is to lay the eggs, so that, as the workers die, worn out with constant toil, there are always others to take their places and carry on the life in the hive.

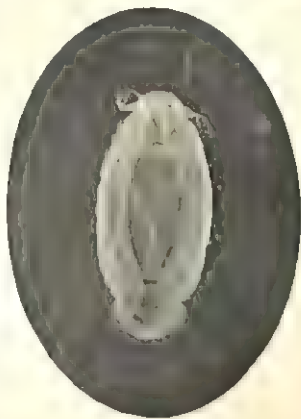
The queen is bigger than the worker bees; she is about the same size as a drone, but her body is longer. Her wings are shorter than the workers', and her sting is very long and curved, and has no poison bag.

The workers treat the queen with great respect and kindness. She has always a circle of attendants waiting upon her. They feed her from their mouths with rich bee-milk, they attend to her toilet, keeping her always brushed and neat, and they gently lead her over the combs prepared for her, so that she may lay an egg in each cell.

In the early spring, when food is scarce, the queen lays only a few eggs at a time; but later in the year, when there is an abundance of nectar and pollen, she may lay as many

as two or three thousand eggs a day, for there is then much work to be done, and many workers are needed in the bee city.

In two or three days' time the tiny eggs hatch, and the wee bee babies lie curled up, each one at the bottom of its own little waxen chamber. A baby bee is no more like a grown-up bee than a caterpillar is like a butterfly. It is just a fat, white, legless grub, and is called a "larva." Baby bees are very different in their ways from baby butterflies. A cater-



A BABY BEE (MAGNIFIED).

pillar, as you know, is quite independent and able to take care of itself from the first moment it makes its appearance in the world; but a bee larva is a helpless little thing, and would quickly die if there were no kind nurses to look after it.

From time to time the nurse bees come round and peep into the cells to see how the babies are getting on. They feed them with

bee milk, pouring it into the cells so that the tiny creatures are actually bathed in the sweet, white juice ; but this rich food is only given to the babies for the first few days ; as they grow bigger they are fed with plain honey and pollen instead.

The babies grow very quickly, and soon stretch themselves out in their cells with their heads towards the open end. They are very hungry little things, and open their mouths eagerly to be fed whenever a bee comes near ; but the nurses will not allow them to have more than they think is good for them. They take good care of the children, but never spoil them.

When five days have passed, and the little creatures have grown so fat that they fill up the whole of their cells, the nurses stop feeding the babies, and shut them up in their cells by fitting a neat little lid of wax mixed with pollen over the top of each one. Then, when it finds there is no more food forthcoming, each little prisoner sets to work to spin itself a tiny silken nightgown, and when this is finished it goes comfortably to sleep.

The larva now changes to a pupa—just as a caterpillar does before it becomes a butter-

fly. . It rests quietly in its cell while its shape is gradually changing, its wings and its legs grow, and all its different parts are formed; and in three weeks from the time when it first came out of the egg, it has become a perfect bee.

The first thing the bee does is to gnaw the lid of wax and pollen that shuts it in, and, finding this good to eat, she very soon finishes it all up and is then free to crawl out of her cell. The new bee is a pale greyish colour; she is very weak, and her legs are so shaky they bend beneath her weight; but almost at once she begins to make herself clean and tidy, she smooths her wings, rubs her eyes, and brushes and combs herself all over. One of the nurse bees generally comes up to help her, and when her toilet is finished, the new bee sets off to explore the city and have a good look round.

For the first day or two, she does nothing but wander about up and down the roadways, watching the throngs of busy workers that fill the hive. She finds the open honey vats and pollen bins and helps herself to some of their contents, and in a very short time the little bee grows strong, her legs become quite firm,

and she is ready to take her place amongst the workers of the hive.

The new bee has a great deal to learn. She does not at first go out to gather honey and pollen, but stays at home and takes her part in all the work within the hive. She makes a few mistakes at first, but she is quick and willing, and the older bees show her what she has to do, so she is soon as useful as any of them. It is the young bees who act as nurses and cleaners. They make the wax, and build the combs; they feed the drones, and take turns in waiting on the queen. A bee does not, as a rule, go out for her first flight until she is a fortnight old; but if the stores are scanty, and there are not enough older bees to gather sufficient food for the hive, she may be sent out to help forage at once.

The first flight is a most important event in the life of a bee. Before setting out she grooms herself with great care, and several comrades will often help to brush her and make her neat and trim. Then with a happy little flutter of her wings she rises into the soft, warm air, pauses for a moment while she surveys the surroundings of the hive, carefully noting any landmark that may help

her to recognise her home again, then away she speeds, anxious to fill her baskets with golden pollen or her honey bag with sweet nectar, and return in triumph with her spoils.

She is not quite sure of what she has to do at first; she has to learn this part of her work just as she had to learn the indoor work of the hive. And whenever you see a worker bee busily hunting over tufts of grass, peering anxiously under leaves, or poking her head into holes and cracks in garden walls, you may be sure that she is a young bee just starting her outdoor work, and does not yet know the right places to look for pollen and nectar. But the wise little bee is quick to learn her lesson; a few experiments teach her where the treasures lie hidden. She soon discovers that she must visit the flowers for the golden pollen and the sweet nectar which lies deep within their cups.

And so the honey bee toils on through the bright spring and hot summer days. Butterflies flit gaily here and there in the sunshine; thoughtless flies dance madly up and down; and thousands of tiny insect folk bask lazily in the sun's warm rays or feast upon the fruit and flowers. But the honey bee takes no rest

or holiday; she works away with restless, almost furious, haste, until at last, after six or eight weeks of constant toil, she can work no more. Worn out with her labours she falls exhausted at her post.

It seems a hard life that the little bee lives, but who shall say it is not a happy one? She takes pride and pleasure in her work, and her whole life is spent in the service of others. Unselfish, busy little bee! In spite of her many faults—her quick temper and her ruthless ways—we cannot but admire her.



CHAPTER IV

HOW THE BEES SWARM

EARLY in the year only worker bees are hatched from the eggs laid by the queen bee; for there is much work ahead, and many workers are needed to gather in the coming harvest of pollen and nectar. As spring advances eggs are laid in the drone cells, which are larger than the cells for the worker bees. Then when the hive is almost full of busy workers and blundering drones, the bees set

to work to make a few new cells, much larger, and quite different in shape from the ordinary kind—they look somewhat like thimbles, or acorn cups, turned upside down. These are “royal cells,” and in them are placed the eggs from which in due time will come royal princesses.

The nurses treat the baby princesses quite differently from the worker babies; instead of “short commons” they give these royal children as much food as they can possibly eat. They pour bee milk into the royal cells until the little princesses are positively swimming in it! and the rich milk is given to them all the time they are larvæ; so the royal babies wax fat, and grow much bigger than their worker sisters.

But even princesses must stop eating at last, and when five days have passed the nurses close the royal cells and, like their worker sisters, the royal babies begin to weave themselves sleeping garments. The spoilt princesses, however, soon grow tired of work, so they stop short, and fall asleep, when they have fashioned a sort of cape only just large enough to cover their heads and shoulders.

When the princesses are ready to leave their

cells, the old queen grows very restless and excited. Even the sight of a royal cell annoys her majesty; and when, at last, she hears a shrill, piping sound coming from within, showing that a young princess has awakened from her pupa sleep and is trying to break out of her prison, she flies into a perfect passion, and rushes towards the cell, eager to tear it open and stab her poor daughter to death.

But this the bees will not allow. A guard of workers draws up round the royal cell and bars the way of the angry queen; and as fast as the impatient princess tries to break her way out, the workers plaster up the door again with fresh wax; so, in spite of her struggles and cries, she is kept a prisoner.

The old queen grows perfectly furious, and rushes frantically about the hive; and soon a regular wave of excitement runs through the bee city. Workers leave their tasks, flock to the store room and fill their bags with as much honey as they can hold, and buzz wildly in and out of the hive. At last it becomes so hot, and the confusion is so great, they can stand the heat and excitement no longer, and they rush forth helter-

skelpter, with the old queen in their midst. The bees have swarmed !

Really the bees seem all to have gone mad. Standing in the midst of a swarm is like being in a storm of black snow. The air is filled with hundreds, sometimes thousands, of wildly whirling little creatures, all singing as loud as they possibly can. You need not fear being stung by bees when they are swarming, as they have all drunk so much honey they have no desire to sting. Soon, with one accord, the bees mount higher and higher into the air, till the swarm looks like a little dark, drifting cloud in the sky. But the queen is heavy, and her wings are not so strong as a worker bee's. She tires, sinks earthward again, and settles on a branch of the nearest tree. The bees all follow and quickly gather round her, and a cluster of bees begin to form on the branch. It grows and grows, until at last the swarm hangs down like a big bunch of black grapes.

The bees are quiet now. Their wild excitement is over. They have lost their home, for they can never go back. Now they must seek a new one.

If a bee-keeper is near, this matter is settled

for the bees, for he will take a straw hive, called a skep, and, holding it under the cluster of bees, give the branch to which they are hanging a sudden, sharp shake, and the bunch of bees falls into the skep. Later on, the bee-keeper will transfer the bees to a wooden hive. He shakes them out of the skep in front of their new home, and as soon as the bees have decided that the hive is a good one, and will make a nice bee city, they all stream in and take possession of it.

But what if the swarm has flown too far from the old home, and there is no one at hand to provide them with a new one? Then the bees send off scouts to scour the country round in search of a new dwelling-place. The scout bees hunt about the neighbourhood, and then fly back to the swarm, which is still clustering round the queen, to report what they have found. As soon as the news comes in that a satisfactory home has been discovered, all the bees, with the queen still in their midst, troop off and take possession of their new abode. If no comfortable hive is to be had, the bees must needs be content with a hollow tree-trunk, or any hole large enough to accommodate the whole party; but if they

can find a vacant hive, or an old straw skep, the swarm is almost certain to enter it.

But what a different place is the empty hive from the comfortable, prosperous city the bees have forsaken! Here are no walls or roadways, no nurseries, no stores of food.



BEES AT WORK ON THE COMB.

The bees have now to begin their work all over again.

The first thing to be done is to make combs, some for the queen to lay eggs in, and others to be stored with honey and pollen to feed all the members of the hive. The bees waste no time in useless complaints, but all set to work to help build the new city. A number of young bees begin to make the wax; they climb up to the top of the hive,

and then hang down in a cluster. The bees in the first row cling to the roof and the rest cling to one another, until a regular curtain of bees, reaching almost to the floor, stretches across the hive.

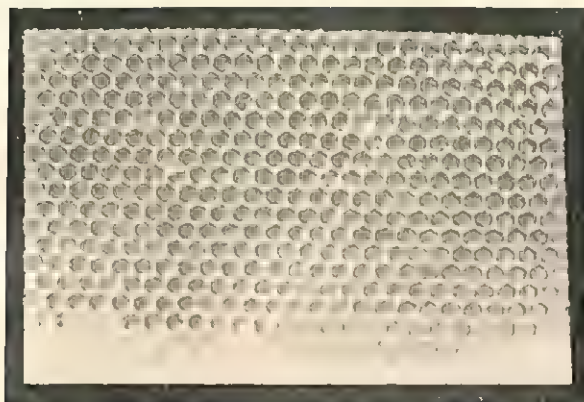
While they hang there, motionless, these wonderful little creatures are turning the honey, with which they filled their honey-bags before leaving the old home, into wax. In about twenty-four hours' time their pockets will be filled; and each little worker will have six delicate white wafers sticking out of her six little pockets, like so many tiny pocket handkerchiefs.

As soon as a bee has her pockets filled with wax, she leaves her place in the cluster, takes the wafers from her pockets with the wax nippers on her hind legs and kneads them in her jaws till the wax is quite soft and pliable. As fast as they are ready the little lumps of wax are fixed to the roof of the hive, and the builders can begin to form the foundations of the combs.

In modern beehives, frames containing wax foundations are always placed in readiness for the bees; this saves the little workers much time, as they can begin to form the

combs at once, and the bee-keeper will have his sections filled sooner.

The combs are built downwards from the roof of the hive, with just sufficient space between them to allow the bees to pass easily up and down. Each comb is composed



SECTION OF HONEYCOMB, SHOWING HOW PERFECTLY THE BEES FORM THE CELLS.

of a double row of cells placed back to back, so that the same foundation forms the bases of two sets of cells. Each cell is a long, narrow chamber, with six sides, every side forming a wall of two cells; so not an atom of space or wax is wasted. If the cells were round there would be waste spaces between

them, and if they were not placed back to back double the amount of foundation would be needed. In fact, the comb made by the little honey bee is so perfectly planned that man with all his scientific knowledge can think of no way by which it could be improved.

While the building of the city is in progress a number of bees set forth to fetch provisions and water for the workers in the hive; each bee before she departs taking careful note of the position of her new home so that she may be able to find her way back again. Before long they come hurrying back, some carrying nectar, some pollen, and some bearing a lump of reddish-brown, sticky stuff, called "propolis," a kind of resin they find in the bark of many trees. With this they carefully fill up every crack or hole they find in the hive to prevent any rain or cold draught coming in, and so make all snug and comfortable. If the hive is a straw one the bees glue it firmly to its base-board with the propolis, and this is used, too, to make a varnish with which the honey combs are painted.

So hard do the bees work to build and furnish their new home, that in a surprisingly short time the queen is again going her

daily round attended by her maids of honour, the cells are being stored with honey and pollen, and work in the new bee city is in full swing.

CHAPTER V

QUEEN OF THE HIVE

BUT what has been happening in the old hive since the queen and the swarm flew so wildly away? There are still many workers left, for all the bees did not rush from their home in this strange manner, and as soon as all is quiet again they return once more to their work.

But now there is no queen in the hive, and this state of affairs cannot continue for long. For if no eggs are laid there will be no new bees; and, as the old workers die off, the hive will gradually become empty. The bees must have a new queen without delay; and in the royal cells two or three princesses are quite ready to come forth, and are impatiently striving to break through their waxen door, every now and then giving vent to the shrill piping cry that so enraged the mother queen.

So the bees decide to let the eldest princess out of her cell, but no sooner is she liberated than she behaves just as the old queen did. The sound of her sisters' voices fills her with rage, and she rushes at the cells in which they are still kept prisoners, and struggles to pass the guard so that she may kill the other princesses.

But this the workers will not allow ; they push and pull the princess away without any ceremony. They will stand no nonsense from her, and she is made to understand that she cannot do as she pleases ; the bees even pinch and bite the angry young princess if she will not obey them. If there is still a great number of bees in the hive the princess may be allowed to fly off with a second swarm (called a cast), and then another one is released from her cell. But if the bees have had enough of swarming they just hustle the princess about, and go on with the work of the hive.

The princess is very forlorn. She is not allowed to kill her sisters, which is the one thing above all others she longs to do, no one pays her any attention or offers her food, and she is hustled and pushed about by the

worker bees as if she is of no account whatever. So the princess wanders sadly about the hive, she is obliged to help herself to food from the common stores, and she feels very lonely and miserable. At last she ventures out of the city gates and takes her first look at the outside world. She hesitates, flutters her wings, then starts off on her first flight; but bewildered by the strong light and the vast world around her she soon returns and creeps back into the hive. Two or three times she takes short flights as if she were testing the power of her wings, and each time she grows a little bolder. Then at last the princess makes up her mind to go off on her wedding flight, for until she is married she cannot become queen of the hive, and the bees will pay her no respect.

So one spring day, when the sun is shining his brightest, the princess comes from the hive, hovers above her home for an instant, then darts aloft into the blue of the sky. The drones from all the hives near by spy the princess, and at once they all speed after her. Up and up flies the princess, and up and up fly the drones, for the princess will choose for her mate the drone who proves strongest and

swiftest in the race. One by one the drones tire and drop back to earth, until at last only one is left, and the princess and the victor vanish from sight.

After awhile the princess comes down from the sky again, and returns alone to the hive. Now the worker bees hasten to welcome her and pay her every kind attention. They brush her, smooth her affectionately with their antennæ, and offer her refreshment. No longer is she a neglected princess; she is queen of the hive, and will be cared for and protected by the workers for the rest of her life.

But the new queen refuses at first to settle down quietly to her work in the hive. There are perhaps two or three princesses still walled up in their cells, and her majesty cannot rest until she has destroyed them. So she rushes to the royal cells (and now the bees stand back and allow her to have her way) tears them open, one after another, and with a quick stab of her long curved sting puts every princess to death!

After this one fierce act, the queen calms down, and, without any more fuss, takes up her duties in the hive: Day after day she

goes her rounds, laying eggs in the brood cells, from which will spring thousands upon thousands of new citizens to carry on the work and govern the city of the bees.

And so the work in the hive goes steadily on; and as the summer advances the bees work faster and faster to gather in sufficient food to last them through the long, cold winter months, when there will be no flowers from which they may glean the precious nectar and pollen.

In the winter the bees cease their work, and the queen lays no more eggs; there are no babies to attend to, no combs to build, no honey to store. So the workers cluster together for warmth in the centre of the hive with their queen-mother in their midst. Their store rooms may be full, but the bees do not know how long the winter may last; so the wise little creatures are careful not to eat more than is absolutely necessary to keep them alive. At stated times a small allowance of honey is served out to each bee, and no one thinks of asking for more. The bees at the top of the cluster open the honey cells and pass their rations down to the rest, and as the lower store cells become exhausted, all

the bees move on together a little higher up the combs.

All through the cold, dull days the bees never leave the hive, but whenever, as sometimes even happens in the winter-time, the sun shines brightly for a few hours, you may see the little people flocking out at the gates to stretch their wings in a short flight round and round the hive.

Winter is a very trying time for the bee people. When the spring returns many have died, and all are weak and feeble. Nevertheless the first warm day brings out the willing workers. The water carriers creep forth to glean the dew-drops that sparkle on the grass blades, and the bees begin a thorough spring cleaning in the hive. All the dead bees are carried out, all rubbish is cleared away, combs are mended, new brood cells prepared for the queen. Whenever the sun shines the foragers come forth to search the golden crocus and the sunny, sweet arabis. Winter is past, summer is coming, and the bee city is awake again.

CHAPTER VI

BUMBLE BEES

IF we watch a border of bright flowers in our garden, on a sunny summer morning, we shall see that many different kinds of bees come to visit it. The trim little hive bee with her quick, business-like ways flies briskly from flower to flower; the great velvety, bumble bee comes sailing majestically along with a loud, booming hum, dives into the Canterbury bells and sets them all a-ringing; fussy little round-bodied bees, covered with fluffy reddish down, buzz about here and there; and basking on the daisy heads or in the heart of a rose, we may perhaps find the little Sleeper bee with her thin black and yellow body and funny square-shaped head. All the bee folk are revelling in the warmth and brightness, and have come to gather treasure from the flowers. And, indeed, they are right welcome to the best our gardens can afford them, for while they are working away so busily for themselves, the bees are all unknowingly working for us too. Without our winged visitors our

gardens could not flourish, we should have but few flowers and hardly any fruit. As they dive into the flowers to reach the golden nectar, the hairy bodies of our bee friends are dusted with precious pollen, from the anthers of the flowers; then some of it is rubbed off on to the stigma of the next flower they visit, and the useful work is done. For, as I dare say you know, pollen must be transferred from one blossom to another or the seed will not set. Some is carried to the plants by the wind; but insects, particularly bees, are the chief pollen bearers.

It has been calculated that a busy bee will often visit three or four hundred blossoms in a day; so however many flowers there may be in our gardens, or in the country-side, there are never too many for the friendly little bees to visit. If you watch carefully you will notice that as a rule a bee goes in and out of the same kind of flower; she will work steadily over the blossoms on the apple trees on one of her journeys, and will not fly off to the clover field or the violet bed until she has been home to empty her honey bag, or her pollen baskets. So the pollen is not wasted by being carried to the wrong kind of flower.

The bumble bees, or humble bees, are the handsomest members of the bee family. There are a great many bumble bees, and they differ very much in size and colour.



GROUP OF HUMBLE BEES.

Some have their black velvet coats adorned with bands of pale yellow, others have golden, orange, or white bands, and some, instead of coloured strips, have the hind part of their bodies clothed with red or golden brown

hairs. The bumbles are "social bees"—that is to say, like their little cousins the hive bees, they live in large companies and work together in a friendly, sociable way. Although they are not quite so clever as the hive bees, the bumble bees are very intelligent and industrious; they are peaceful folk, too, and never use their stings unless they are provoked.

The nest of a bumble bee is not so well planned, or so orderly, as a city of hive bees. The cells in which the eggs are laid and the baby bees reared are placed just anyhow in a higgledy-piggledy fashion, mixed up with honey pots and pollen tubs, which are often all shapes and sizes as if each worker had built just as she had a mind to; and in and out amongst all this jumble run little straggling paths for the bees to pass to and fro. What makes the nest look particularly untidy is the heap of empty and often broken cells to be seen. For the bees do not use their nursery cells more than once, but build fresh cells on the top of the old ones for the next batch of babies; though they may fill a few empty cells with honey, and break up others and use the wax to build new ones.

The honey pots are always left open for all to help themselves. No honey is stored for the winter, for the little colony of bumble bees lasts only through one season. As soon as the cold weather sets in all the bees die off with the exception of a few young queens, who creep into some warm corner, under a heap of moss, or leaves and rubbish, and when winter is passed come out to found new nests.

When a queen bumble bee wakes up in the spring-time she finds herself alone in the world, without a single worker to help her. But the brave queen is not daunted; as soon as she has taken a little food and recovered her strength she sets to work, all by herself, to start a new nest. She collects little bundles of moss and drags them to the chosen spot, which may be simply on the ground under a heap of moss or leaves, or a nice dry hole in a bank. Working with her strong jaws and her sturdy legs the bee bites and tears and kicks the moss into place, and soon she has fashioned a soft, warm little coverlet. Under this Mrs Bee builds a little waxen cell, then out she goes to gather nectar and pollen, which she kneads into a soft, sweet cake with her jaws.

The honey cake is placed in the cell, then Mrs Bee lays several eggs on the top of it and plasters up the cell with wax.

The queen now takes a short rest and then proceeds to build a few more cells, and in each one she puts a honey cake and a tiny cluster of eggs. By the time three or four cells are finished the eggs in the first one hatch, and the baby bees set to work to demolish the food placed all ready for them by their thoughtful mother. Now Mrs Bee has to work harder than ever, for not only are there cells to build, eggs to lay, and honey cakes to make, but there are several hungry children to feed as well. She toils bravely on, however, and the little larvæ grow apace, for mother bee supplies them with plenty to eat—pouring in a sort of honey porridge from her mouth through a tiny hole in the side of the cell. The larvæ soon grow so fat they become too big for their nursery. They press against the walls, stretching them out in all directions; then just as it seems that the thin wax must break the larvæ stop eating and turn to pupæ. In about four weeks from the time the first eggs were laid the first little batch are ready to leave their cells, and mother bee hurries eagerly



WOOD WASPS : THE GIANT SIREX AND THE SMALL SIREX



WASPS' NEST WITH PART OF THE PAPER COVERING,
REMOVED

to break down the nursery walls and welcomes her eldest daughters.

The bees that come from the first cells are always workers, and without loss of time they all set to work to help the queen mother; and as soon as there are sufficient workers in the nest to build the cells, fetch in provisions, and feed the babies, the queen leaves all this work to them and has a much easier time. She goes no more abroad, but stays at home, and contents herself with laying eggs.

Bumble bees' nests are never very large; there may be perhaps three or four hundred bees living in a prosperous colony, but some nests contain only fifty or sixty workers. They are most industrious little people—they are up with the lark and work away until quite late in the day. Indeed, in hot countries bumble bees sometimes do not go to bed at all, for they have been seen busily working by moonlight; while some nests are said to have a trumpeter bee, who makes a shrill piping sound to call the bees to work as early as three o'clock in the morning.

In the spring and early summer only workers are hatched, but later on drones appear, and then a few princesses. The prin-

cesses do not fight and kill each other as the princesses in a hive do, and the workers do not kill the drones, but all live peacefully together until the summer wanes. Then the drones and princesses leave the hive, and as the days begin to grow cold and chill the bees cease to work; and before winter with its frosts and snows sets in all the bumble bees are dead, except a few young princesses who crawl into some warm corner and sleep until spring comes again.

Living in the nests of bumble bees we may sometimes find several bees who are not the rightful inhabitants. They are just like the true bumbles in appearance, although they are usually somewhat larger. These strange bees are queens who do not trouble to make nests for themselves, but calmly take up their residence in bumble bees' houses. They do no work beyond constructing a few large cells in which they place their eggs, and they leave their babies to be brought up by the bumble bees with the rightful children of the nest. The bumble bees make no objection to this arrangement, and the lazy strangers spend their days buzzing about the flowers, sipping nectar, or, if the weather be dull, they stay

at home and eat the honey and pollen gathered by the industrious workers in the nest.

CHAPTER VII

SOLITARY BEES

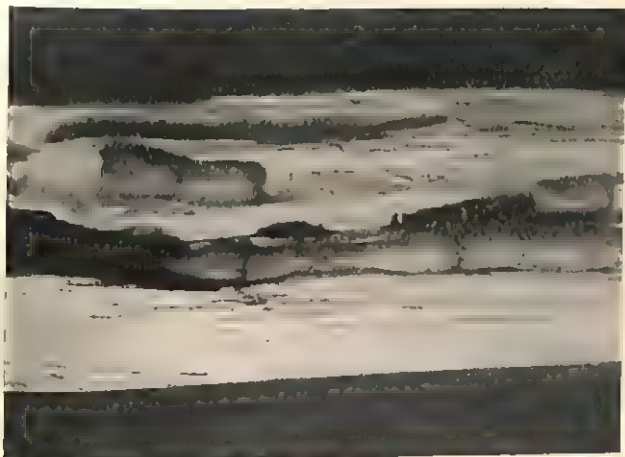
ALL bees do not live in colonies and work together in friendly fashion like the honey bees and the bumble bees. By far the greater number live quite alone, and so are called "solitary bees." These lonely bees are quite as interesting in their ways as their "social" cousins, and many of them make the most wonderful and beautiful little nests.

The Leaf-cutting bee you may often see busy amongst the rose bushes. She is a sturdy-looking little insect, about as big as a honey bee, and is covered with soft, brown hair. If you watch her at work you will see that instead of gathering nectar and pollen she is busily engaged in cutting out a piece from a rose-leaf. The little bee stands on the leaf, turning round in a circle as she works, her sharp jaws goes snip, snip, snip, like a

tiny pair of scissors, until the piece is almost severed, and one would think with the next bite bee and rose leaf must fall to the ground; but just at the last moment the little bee spreads her gauzy wings and off she goes with her prize.

She flies to a spot she has already fixed upon; it may be a little tunnel in the ground made by a worm, or a burrow in an old wooden gate post, or decaying tree-trunk, hollowed out by some other insect, and she disappears inside. Presently she pops out again without the leaf, and is off again to the rose bush. She flies backwards and forwards several times, and on each homeward journey she carries a tiny, long-shaped piece of leaf clasped firmly with her front legs and tiny jaws. Some leaf-cutting bees cut as many as thirty of these long-shaped pieces, but others content themselves with ten or twelve. All the little pieces are exactly the same size and shape, and the bee fits them neatly together, one piece overlapping the next in order, and fastens them carefully with a kind of glue from her mouth—and soon she has made a rose-leaf cell shaped like a little thimble. When this is finished the bee pours a mixture of honey and

pollen into the rose-leaf thimble, and on the top of this she lays an egg ; then off she goes to the rose bush again and cuts off three or four new pieces, round this time, and deftly



THE ROSE-LEAF CELLS MADE BY THE LEAF-CUTTING BEE.

fits them into the top of the cell to form a lid.

The bee makes five, six, or seven of these rose-leaf thimbles, and fits them all closely together, one on the top of another, in the narrow tunnel. In each one she places an egg and a honey cake, and then the clever little bee carefully closes the entrance and flies away to look for another burrow. The

bee fills from four to six burrows with these little thimbles, and by that time she is quite worn out with her labours, so she spends the remaining summer days resting amongst the flowers and refreshing herself with little sips of nectar.

In due time baby bees hatch from the eggs in the rose-leaf cells, and the little things set to work without delay to eat up the nice sweet food their kind mother had placed all ready for them. When this is finished each larva spins a silken cocoon and falls asleep until the following summer. When they awake they are no longer fat little grubs but perfect leaf-cutting bees, and they bite their way through the rose leaves and come out in the sunshine. The little male leaf-cutters do no work, but spend their days in enjoying themselves; but each little lady bee, after she has taken a short holiday, sets to work to make rose-leaf thimbles for her children, just as her mother did before her.

Another little bee called the "Poppy bee" makes even prettier nurseries for her little ones. She is a small bee with a velvety black coat ornamented with narrow rings of fluffy white down. The Poppy bee first

scoops out little hollows in the ground, choosing dry, sandy soil for her operations. She pounds the sides of the burrow to make them firm and lasting, and then lines them with pieces of the petals which she cuts from the flowers with her strong, toothed jaws. Mrs Bee is very particular about this soft, pretty lining to her nest, and presses and smoothes out every fold and crease with her head and legs before she puts the honey cake and a precious egg within; then before she closes the mouth of the burrow she carefully folds over the ends of the poppy petals, so that no grains of sand can fall in the nursery and spoil the bee baby's food. When this is done the bee fills up the hole with soil and rakes over the top with her feet to hide the entrance to her nest.

There are other little bees, called "Miner bees," no bigger than flies, that tunnel in sandy soil or in gravel paths; others hollow out the stems of the blackberry, and form their little cells inside by making partitions with the pith they have scraped out. Another family of tiny bees cleans out old straws and divides the inside into cells with the help of a little mortar; while a bee called the "Carder bee"

will sometimes even choose a snail shell in which to make its nest.

The Carder bee lines its nest with a layer of soft cotton, which it strips from the stems of plants growing near by. She runs up and down the stems and shaves them bare until she has collected a ball of cotton almost as big as herself, then she tucks it underneath her, holding it tightly with her legs, and flies off with it. If an empty snail shell is not handy the bee will use the deserted nest of another bee, or any suitable hole she may find ; but she always lines her nest with cotton, spreading it out with her fore-legs and pressing it down with her head until it is nice and smooth. Then she finishes it off with a coating of glue, to prevent the honey mixture she puts inside the cell for the larvæ sinking into the cotton. When the nest is finished the bee blocks up the entrance with tiny scraps of wood, little stones, or any odds and ends that may be lying near by.

The Carder bee, the Leaf-cutter, and many of the little miners, we may find at work in the summer time in almost all parts of our own country—in the garden, in the sand pits, and in the fields and lanes ; but the Carpenter

bee and the Mason bee live in sunnier southern lands. The "carpenter" is a native of the south of France. He is a splendid fellow, with a black velvet coat and deep violet-coloured wings, and is larger than the biggest bumble bee. But *Mr* Carpenter is no workman; he, as is the usual way in the insect world, spends his life in pleasure, while his good wife does all the work. *Mrs* Carpenter is just as fine looking as her lazy mate; and she has a pair of very powerful toothed jaws. With these tools she cuts and saws into the trunk of a dead tree, or an old dry stump of wood, making long galleries that are often a foot deep. These she fits with partition walls, made from the sawdust she has taken from the tunnel, mixed with the gluey saliva from her mouth. The bee makes three or four galleries side by side. These all open into the same passage or lobby with one exit to the outer world; so when



THE CARPENTER BEE.

the young carpenter bees are ready to leave their little nurseries they all pass out of the same hall door.

This piece of carpentry takes Mrs Bee several weeks to accomplish; should she, however, find a tree that is already bored with suitable tunnels she is wise enough to take possession of them, and so save herself a great deal of labour. In this case, all mother bee has to do, to make the cells in which she places her eggs, is to fit a number of sawdust partitions into the ready made galleries.

The Mason bee also lives in the south of France; it is a hairy little creature, smaller than a bumble bee but rather larger than a honey bee. Mother mason bee makes her nest with mortar, which she mixes for herself, using dry, powdery soil and her own natural glue. For the foundation of her nest she usually chooses a stone, though some mason bees build on the branch of a tree or under the eaves of country cottages. Having mixed a little mortar the bee plasters it firmly on the stone in the shape of a ring. She adds pellet after pellet of mortar, tiny stones, and bits of gravel, working round and round, and adding layer after layer, until she has built a

little turret about an inch high of a sort of rough-cast cement. Mother bee then stores this little castle with honey and pollen, lays an egg on the top and plasters up the opening. Six or ten cells are built side by side by this clever little mason, yet the only tools she uses are her jaws and her fore-legs! When all the tiny turrets are finished, and stored, the bee spreads a thick layer of mortar over the whole lot, all her neat work is hidden, and when the little mason flies away her nest looks only like a clod of dry earth sticking on the side of the stone.

There are no workers amongst the solitary bees—only males and females. And it is always the little mother bee who takes so much trouble to build nurseries, and provide food for the baby bees.

CHAPTER VIII

WASPS AND THEIR WAYS

It was a clear, bright May morning when the queen wasp crawled from beneath the heap

of leaves under the oak tree where she had spent the winter sleeping.

She felt dazed and weak, and no wonder, for she had tasted no food since the end of last October. She rubbed her face and her eyes with her fore-feet, like a cat washing its face, smoothed her legs and her long, thin, black and yellow body, fluttered her wings, then feeling a little bit refreshed she started off to find some breakfast.

But the sun hid behind a cloud and a cold wind sprang up; so the wasp with a little shiver crept into a crack in an old ivy-covered wall, and decided to take another nap until the weather changed again.

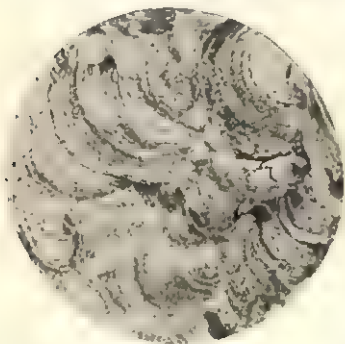
The spring days soon grow warmer and her majesty is once more able to be out and about. She spends a few days flying here and there, feasting on the nectar of the flowers until she grows quite strong and vigorous. Then she starts house-hunting, for she begins to feel anxious to set up house-keeping in a home of her own.

The wasp runs about eagerly over a sunny bank covered with tufts of grass, straggling brambles, and trails of green ivy. She searches the ground very thoroughly, peer-

ing, under every clump of leaves, poking her funny-looking head into every hole and corner, and feeling everything she comes across with her stout, rod-like antennæ. Mrs Wasp is by no means easy to please, and she examines every inch of the ground for several yards round before she finds a place that appears to satisfy her requirements. At last she comes upon a nice roomy hole in the bank (once the home of a family of field-mice), and decides that, with a little alteration, this will do very nicely. The entrance to the hole is well protected by a moss-covered stone which juts out from the bank, and a narrow, winding passage leads down to the cosy hollow where, last season, father and mother mouse brought up a family of seven little mice, and kept their store of seeds and beechnuts.

Having made up her mind to take possession of the hole, Mrs Wasp crawls in and walks all over her new home, and then proceeds to "tidy up" the place. She scrapes at the wall, here and there, with her fore-feet, carries several little pellets of earth outside the nest and throws them away, and bites off a blade or two of grass growing round the entrance which seem to vex her tidy mind.

For the next few weeks the queen wasp is very busy indeed. All alone she lays the foundations from which, in time, will grow a fine wasp city. First she flies off to the nearest rotten tree stump, or an old wooden fence that has become dry and splintered. She bites and tears off tiny fragments of wood and chews up the fibres, mixing them



PART OF THE PAPER COVERING WITH WHICH WASPS SURROUND THEIR NESTS.

with a gluey liquid in her mouth, until they are reduced to a soft, greyish pulp. For wasps do not build their nests of wax, as bees do; the walls and cells are all made of paper which the clever little insects

manufacture for themselves. The wasp carries pellet after pellet of soft paper into the hole in the bank, and works them into a short, stout pillar fastened to a projecting root at the top of the nest (for a wasp's house is always built upside down, the first floor, as it were, being next to the ceiling). From

this little pillar she suspends a small roof, like an open umbrella. Under this shelter she makes two or three cells, and then the first eggs are laid.

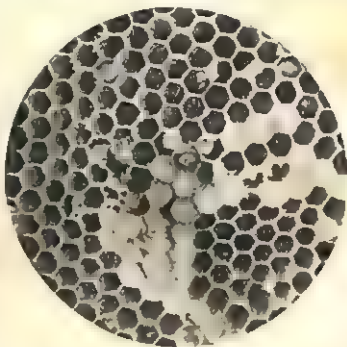
In about eight days' time the eggs hatch, and the queen, who in the meantime has been busy building more cells and placing eggs in them, has now, to add to her labours, several hungry little grubs to feed. Still she toils on, fetching food for her babies, enlarging their cells as they grow, making new cells and laying eggs; it is really a wonder the poor queen is not quite worn out!

Every day now, as fresh eggs hatch, there are more and more mouths to feed, yet the queen wasp manages it all. But help is now at hand, for after she has toiled alone in the nest for a whole long month, her labours are rewarded, and the first few worker wasps come out of their cells ready to help their devoted mother.

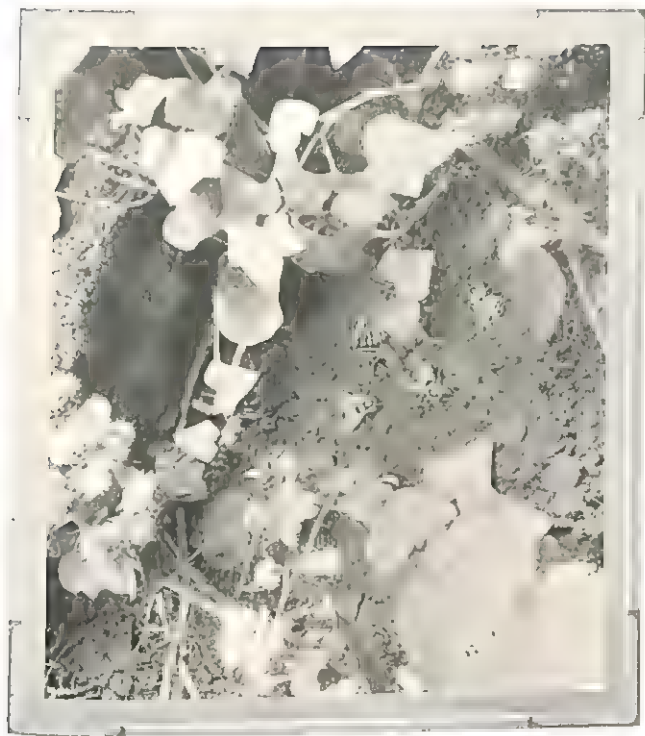
After this joyful event, fresh workers are added to the little colony every day. The wasp city grows rapidly, and soon the queen spends all her time laying eggs while her daughters do all the rest of the work.

The workers now make the paper, build

the cells, go out to fetch provisions, and look after the babies. There is no end to the work in the wasp city; no sooner is one floor completed than the workers start to make a new one beneath it, joining it on to the one above with two or three short little paper pillars. The cells all open downwards, but the babies never fall out, and the nurses are able to walk on the roof of one storey while they feed the larvæ in the floor above, as they hang from the ceiling in their paper cradles. As each new floor is added the outside wall is enlarged; and the little paper umbrella, which the queen hung from the roof of the hole in the bank, grows into a thick, warm cover surrounding the whole of the nest. Sometimes the hole itself becomes too small for the ever-increasing swarm of wasps; then the little creatures set to work to make it bigger, by digging out



PAPER COMB IN A WASP'S NEST.
IN THE CAPPED CELLS THE BABY
WASPS ARE CHANGING INTO PERFECT INSECTS.



THE ENTRANCE TO A WASPS' NEST



BEES GATHERING POLLEN

the earth all round and carrying the pellets of soil out of the nest.

When summer is at its height, the nest, that started with just one queen wasp, may contain as many as three or four thousand busy workers; and all day long during the hours of sunshine a constant stream of "yellow jackets" may be seen pouring in and out of the entrance in the bank—some starting out in quest of food, or wood for paper-making, others returning with their loads.

Wasps are not content with a diet of nectar and pollen, like the peaceful bees, although they are very fond of sweet things, as everyone who has seen them feasting on the jam, and dipping into the marmalade on the breakfast table must know; and they often do great harm in orchards by biting into the pears and plums. But baby wasps need fresh meat as well as fruit and honey, to make them grow up into strong, healthy insects. So troops of wasps will often invade butchers' shops and cut off little pieces of meat to carry home to the hungry children in the nest; while many a "yellow jacket" pops in to dinner with us uninvited, and helps herself

to a slice from the joint. Next time a wasp joins your dinner party, just watch the clever way she cuts off a tiny scrap of meat with her strong jaws.

But a butcher's shop, or a house where meat is to be had, does not often happen to be just next door to a wasp's nest; and as a rule wasps catch and kill flies, and make them into a kind of fly paste for the hungry larvæ. The wasp is a regular huntress. She flies swiftly backwards and forwards over a field or garden, then down she pounces, just like a hawk, on a big, lazy fly who is buzzing about the flowers. Sometimes, quick as she is, the fly is quicker and darts off just in the nick of time. But the wasp is after it in a moment, and an exciting chase begins. Sometimes the fly escapes, but more often the little huntress captures her prey. Then down on the ground the wasp and the fly tumble together; the fly struggles, but the wasp stabs it with her poisoned dagger, and the fight is ended. Then, after cutting off the wings, the feet and the head of the fly, the wasp carries off her prize to the nest.

Towards the end of summer the wasps build larger cells, and in these the drones and

SOCIAL AND SOLITARY WASPS 67

queen wasps are reared. The queens and drones soon leave the nest, and as the days grow colder, the workers grow tired and feeble, and stay at home in the nest more and more. There are still many larvæ left in the cells, but the wasps have not strength to hunt for food for them any longer, so, instead of leaving them to die of starvation, the wasps drag the little things from their cradles and kill them.

There is now no work left for the wasps to do. Soon they all die from cold and starvation. Of all the busy throng not one is left. Only the young queens who had already left the nest live to the following spring, tucked away in some snug corner where the cold frosts cannot harm them, to become the founders of new wasp cities.

CHAPTER IX

SOCIAL AND SOLITARY WASPS

No one is particularly fond of wasps. To be sure, their sting is very painful, and they often spoil a good deal of fruit. But wasps

are not nearly as bad as they are painted; they are really not at all bad-tempered, and never sting unless they are interfered with. Of course, it is not wise to touch a wasp, as naturally it will be frightened and sting in self-defence; but you need not be afraid even if a wasp settles on your hand, for as long as you keep still it will not harm you.

Even the hornets, although they look so terrifying, are peaceful enough when not annoyed; and if people would only let them alone instead of flapping at them, they would have no desire to sting. Hornets are a large kind of wasp. They build their nests in hollow tree trunks, or sometimes under the roofs of houses.

A small wasp, called the "Bush wasp," sometimes builds under eaves, too, or in corners of walls, but more often its pretty little round nest is found hanging on the branch of a tree, or in the midst of a thick bush. On no account should you touch one of these wasps' nests, for that is one thing the wasps will not allow, and an army of fierce little warriors will sally forth and attack anyone who dares to interfere with their home.

The "Wood wasp," a large insect banded with black and yellow in the usual wasp-like fashion, is often mistaken for a hornet, and sometimes causes quite a panic by suddenly



GROUP OF SOLITARY WASPS.

appearing and buzzing about in shops or houses. Its long body ends in a long, straight tail, which sticks stiffly out like a needle, and many people imagine that this is a "sting" which the great wasp-like creature is anxious to plunge into them. But, as a matter of

fact, the "Wood wasp" is quite harmless, although it certainly does look rather alarming. The terrible looking "sting" is not a poisonous weapon, but a handy tool with which "Mrs Wood Wasp" bores little holes in the wood of fir trees, and in these she places her eggs.

The "Wood wasp" is not really a wasp at all, although it belongs to the same order of insects as the wasps and bees. It is a great four-winged fly whose proper name is the "Giant Sirex."

There are not many of these insects in our country, but on the Continent they fly about the fir plantations in great numbers, and do a great deal of harm by piercing the trees that have been felled by the woodmen. Mother Sirex lays about a hundred eggs, and the holes in which she places them are so small that they are not noticed. But as the sirex grubs grow they enlarge the holes, and after the tree has been sawn up, and the wood is used in building houses or making furniture, they are often still living contentedly within it. Then one fine day (when the insects have completed their transformations) folks may be startled by seeing a number of great Sirex

flies popping out of the window frames or the legs of the dining-room table.

There are solitary wasps just as there are solitary bees, and they are quite as interesting in their habits. There are no workers, and each little mother wasp toils alone to make a cosy dwelling-place where her children may dwell in safety, until they become perfect insects, and are able to take care of themselves.

There are so many of these clever insects, and they are all so interesting, that I hardly know which to choose to tell you about. The greater number live in warmer countries; but we may find several different species of solitary wasps in our fields and lanes, burrowing in the ground or in banks and sandy cliffs, tunnelling into stems of plants and decaying wood, or busily scraping holes in the crumbling mortar in old walls.

An old sand pit is a splendid place to look for these little creatures. If we visit one in August, or early in September, we shall very likely find the steep sides of the pit dotted all over with tiny round holes that look as if they might have been made with a pencil; and if the day be warm and sunny, the sand cliffs

will be alive with a busy company of little black and yellow "sand wasps." Some are furiously scraping and digging in the sand with their fore-feet, sending it out behind them in little waves with a kick of their hind legs; others who have proceeded farther with

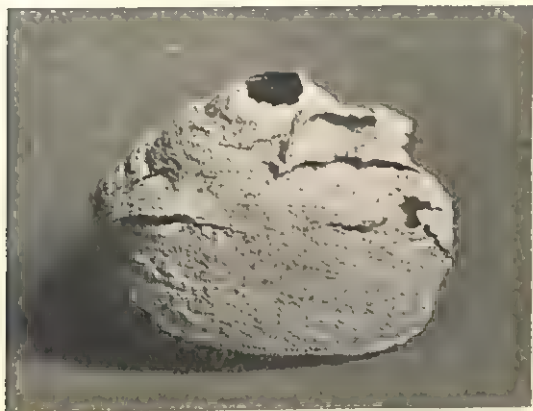


A LITTLE SAND WASP.

their excavations appear from time to time at the entrance to their tunnels, moving backwards, to sweep out the loose sand. Some little sand wasps are taking a short rest, and their quaint square-shaped heads can be seen peering out of their burrows. Some are flying away from the colony, others returning and popping down into their holes, and all

the time a shrill, excited hum goes on from the throng of cheerful workers.

You may perhaps think that these little insects cannot be "solitary" wasps, as here we find ever so many working away in company ; but although they are working side by side,

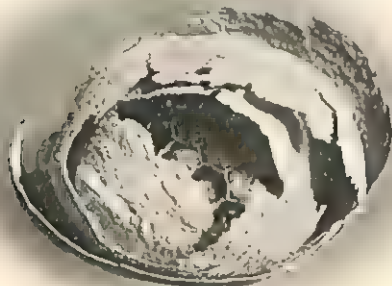


A SMALL BUSH WASP'S NEST.

each wasp is working entirely on her own account. She has no objections to neighbours, but takes no interest in their affairs.

As soon as a wasp has finished her tunnel and made a kind of little pocket at the end, she starts off on a hunting expedition. If you saw her flitting here and there over the gorse and bracken on the edge of the sand

pit, you might think Mrs Wasp was enjoying a little holiday, and was just playing about. But no, she is on the watch all the time, and suddenly down she pounces on a big fly who was taking a nap in the noonday sun. She drops with her victim to the ground, stings



INSIDE OF SMALL BUSH WASP'S NEST, SHOWING LARVÆ IN THE CELLS.

it quickly with her poisoned dart, then, gathering it up underneath her body, she clasps her burden tightly with her legs and flies away back to her den.

Now the strange thing is that the wasp has not killed that fly. She has just stung it sufficiently to stupefy it. She stores it away in the little pocket at the end of her burrow,

and when she has caught several more flies, and treated them all in the same way, she will lay an egg beside them and shut the door of the cell. The poor flies lie numbed and motionless, and when the little grub comes out of the egg it will set to work to eat them all up. In this way the wise little wasp provides fresh food for her children. If the flies were killed outright they would be all dried up and unfit for food before the eggs hatched.

Two or three little pockets are made and stored in the same way, before the wasp closes up the tunnel; then, her work done, she flies off and spends the last few summer days in resting and amusing herself.

Some solitary wasps store caterpillars instead of flies, some hunt spiders, some beetles, some grasshoppers, others ants. Each different kind of solitary wasp has its own particular idea as to what is the best food for its children.

It seems wonderful indeed that these little insects should take so much trouble for the children they will never see; and stranger still, that these wasps who themselves live entirely on the juices of flowers and fruit, should know that their babies will need insect food.

CHAPTER X

THE "LITTLE PEOPLE"

LET us go out into the pine woods. The air is sweet with the scent of the pines, and the sun is sending long slanting shafts of golden light down through the dark, leafy roof, between the pine stems which stand up straight and tall like the masts of great ships.

The ground is covered with so thick a carpet of pine needles that our footsteps are scarcely heard; all is still and silent; the wood seems deserted.

But if you think you are alone in the wood you are very much mistaken. Here we are in the midst of hundreds of thousands of tiny folk, surrounded by miniature towns, and cities, and roadways, all belonging to, and made by, a race of clever, industrious little people whom we call the "Wood ants."

Dotted about amongst the pine trunks are many little hillocks of pine needles. They are of all sizes, from small round masses just raised above the ground to fine big castles two or three feet high. Every hill has been

built, or is being built, by those strange little folk; and in each of the larger hills there are as many ants living together as there are people in a large town such as London or Liverpool.

An ant hill does not look so very wonderful at first sight perhaps. It seems but a medley of pine needles and tiny bits of things all piled up together as if someone had poured them all out of a sack on to the ground. But when we think that every one of those millions of needles and twigs has been carried here by the little ants, the feat seems truly astonishing; and if, by some magic, we could make ourselves as small as the tiny inhabitants of the ant hill, we should discover that the jumble of odds and ends is really a wonderfully built city.

Here are many doors and gateways, leading to long, winding pathways where we might easily lose our way. There are halls, and rooms and galleries on every side; and in and out and up and down move thousands upon thousands of the ant people—just as busy throngs of human folk pass to and fro in a crowded town.

We should have to beware though, however

small we made ourselves, how we attempted to enter the kingdom of the ants, unless our "magic" was sufficient to deceive the little people, and make them believe we belonged to their tribe—for ants never allow strangers to enter their gates. An ant from one hill dare not enter another, even though the two hills may be side by side. All the ants in one nest know each other, and if by some accident some are carried away, and then after a time find their way home again, they will be at once recognised by their comrades, even though two or three months have passed; but if stranger ants appear, the rightful inhabitants of the city fall upon them furiously, and either kill them or drive them away.

But let us watch the little people for a while, to try and find out what they are all doing. At first all seems confusion. All over the ground and up the tree trunks ants are running about in all directions, in what seems to us an aimless sort of way. But it is not so really, and it soon becomes plain that, although here and there a little party are evidently making holiday—skipping and frisking about in playful glee—the majority are intent on some important business. Quantities of ants

are hurrying to and fro, following regular paths stretching from the nest to different parts of the wood. Those on the homeward journey are carrying pine needles, tiny pieces of twigs, scraps of leaves, or grains of earth in their jaws, to add to the nest, or mend some part that has been broken down. Here comes a party of hunters dragging home a big, fat caterpillar they have killed, followed by a kind-hearted ant carrying a wounded comrade carefully in her jaws. Gangs of little people are engaged in clearing the roadways or making new paths, by carefully removing pieces of sticks, leaves, or other little obstacles, that might hinder the workers as they passed along with their burdens. As we watch we shall see that two or three ants will often stop and have a little chat by the way. They touch each other gently with their antennæ, and by the way these little feelers move and quiver it is plain to see the ants are really talking, although, unfortunately, we cannot understand their language.

Parties of ants are hurrying from the nest, some to hunt for food, some to fetch building material, and others to milk the cows. The milkmaids march steadily along a path lead-

ing to the edge of the wood, and climb up on to a bush where their cows are feeding.

The ant cows are those destructive little aphides, or green flies as they are often called, that crowd on the leaves and stems of plants, sucking away at the juices, and the "little people" milk them by gently tickling their sides with their antennæ. This seems to please the "cows," and little drops of sugary syrup ooze from two tiny tubes which the aphides have at the end of their bodies. This syrup is called "honey-dew," and the milkmaids lap it up till their pouches are full, then carry it back to the nest to feed the other ants and the babies at home. The ants are so fond of honey-dew that they take the greatest care of their cows; they protect them from the attack of other insects, shelter them in their nests, and even build cowsheds of earth over the aphides which feed on the roots of plants. The little yellow field ant keeps large herds of ant-cows, and is, in fact, a regular little cattle farmer. In the autumn, when the aphides lay their eggs, the little yellow ants go forth and collect them, and carry them into the nest. They keep the eggs carefully through the winter, and when

in the spring-time the young aphides come out, the ants carry their little cows outside and place them on the daisy leaves growing round about; and all through the spring and summer the little yellow ants go forth daily to milk and tend their herd.

In every ants' nest there are three kinds of ants — queens, males, and worker-ants. The queens are larger than the workers, and two or three often live quite contentedly in the same nest, and do not fight as queen bees do. The ants are very fond of their queens; they feed them, stroke them with their antennæ, keep them clean, and a band of workers always follows them about wherever they go. An ant queen does not leave the nest; she is much too busy laying eggs. As fast as they are laid the workers pick up the tiny, oval, whitish things and hurry off with them to special rooms, where they are kept together until they hatch. A certain number of ants are always watching over the eggs; they lick them to keep them moist, and carry them from one room to another, if they think they are getting too hot, or too cold; and as soon as one hatches, a nurse carries the new baby off to one of the nurseries.

The ant babies are helpless little grubs. They can do nothing but wriggle their soft white bodies and open their tiny mouths when they want some food; but the kind nurses take the greatest care of their little charges. Every morning the babies are carried up from the night nurseries low down in the nest, to the day nurseries near the top of the ant-hill. Here the nurses feed them and clean them by licking them gently all over, and if the day be warm and sunny the children are carried out on to the top of the nest for an airing. The nurses never leave the babies alone for a moment, but are always feeding them, carrying them about, or patting and stroking them with their antennæ; should a cloud gather in the sky, or any danger approach the nest, the little people pick up their precious babies and run indoors with them as fast as they can.

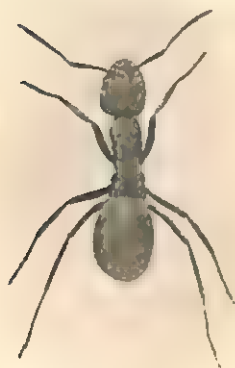
When the little larvæ are full grown they spin for themselves tiny silken cocoons, and in these little cases they rest until they have changed to perfect insects. It is these cocoons which are collected and sold as food for young pheasants and gold-fish, and wrongly called "ants' eggs."

The little people take quite as much care of the cocoons as they do of the eggs and larvæ. They keep them spotlessly clean, and carry them from one room to another, never letting them grow too hot or too cold; then, when at last the new ants are ready to leave their cases, the nurses hasten to help them out. They carefully snip open the silken cocoons with their jaws, and then free the little prisoners from their pupa skins. They smooth them all over with their antennæ and help them to stand up on their legs, which are at first doubled all up underneath them. For the first few days the new ants are very feeble, but the kind workers feed them, show them their way about the city, and introduce them to their comrades, and before very long the new arrivals have grown quite strong and are able to bear their share of the work of the colony.

The worker ants are quaint-looking little people, with funny flat heads and antennæ that have a joint like an elbow, so that they bend in the middle. The two parts of an ant's body are joined by a fine thread, which looks as if it had a knot in it. Some ants have one and some have two knots, and the

ants with two knots possess a sting, while those with only one knot have none.

The worker ants have no wings, but the male ants and the queens when they come from the cocoons have four beautiful gauzy wings. On a still, warm summer day, thou-



A WORKER WOOD ANT.

sands upon thousands of these winged ants come pouring out of the nests and rise together into the air. They dance and sway in the sunshine, their wings gleaming with rainbow hues, as they drift here and there like a little cloud; but soon the breezes

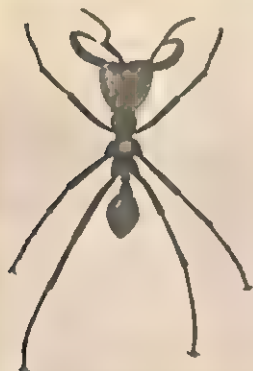
disperse them and they are wafted away. But, sad to say, a sorrowful fate overtakes the little winged ants when their joyful flight is over. As they sink once more to the ground they are gobbled up in thousands by the birds who look upon a swarm of ants as a splendid feast. No male ant ever returns to the nest, and only

a very few queens escape the general slaughter. These either return to the old nest or, with the help of a few workers, start a new one. But before a queen ant settles down in her house she tears off her beautiful wings; her careless, merry days are over—she will never fly again.

There are many different kinds of ants, just as there are many different races of mankind in the world, and each tribe has its own particular habits and customs. There are Slave-making ants who make raids on other tribes and carry off their grubs and cocoons. They take good care of their little captives, who, when they grow up, are made to work for their owners. There are Robber ants—tiny little creatures who make their homes in the walls of the large wood ants' nests. When their big neighbours are off their guard the robber ants rush out, seize some of their eggs and larvæ, and scuttle back to their dens; and although the angry wood ants chase them, they cannot squeeze through into the tiny galleries where the wicked little robbers are eating up their children.

There are Harvesting ants who clear large spaces round their nests and grow a crop of "ant-rice." When the seed is ripe the ants

gather in the harvest and cut down the stubble, clearing the ground for the next year's crop. These little harvesters live in the south of Europe, in India, and in Texas. There are all sorts of interesting ants found abroad, which are even more astonishing in their ways than the English ants. In South



A "MAJOR WORKER" OF THE
FORAGING ANTS.

America the Umbrella ants are a terrible pest to the human inhabitants, as they ascend the trees in thousands and strip them of their foliage, which they use for making a kind of thatch to cover the mounds of earth over their underground dwellings.

It is the strangest sight to see thousands of these little people marching along in procession, every one holding aloft in its jaws a tiny piece of leaf, about the size of a sixpence, like a little umbrella.

The Foraging ants, too, live in South America. They have two kinds of workers; some with very large heads and enormous jaws, called "major workers," and others with small heads and ordinary-sized jaws, called "minor workers." These foraging ants go out in regular hunting parties, killing and devouring all sorts of small creatures that fall in their way; and, strange to say, while some tribes of foragers can see quite well, others are totally blind, and always move along under covered ways which they make just beneath the surface of the ground as they march through the forests.

I wish I could tell you more of the ways of these wonderful little ant people—of the great cities they build, the battles they fight, and all the clever things they do. But there is no more time to talk about them now. They belong to the same order of insects as the industrious bees and wasps. Many insects are more beautiful, but the bees, the wasps, and the ants are far and away the cleverest and most intelligent little people in the "Insect World."









